

Echinoderms

of the Coastal Carolinas, Georgia, and northern Florida

The echinoderms are a phylum of exclusively marine animals; only a few species are able to survive in brackish waters. The group is comprised of the familiar sea stars, sea urchins, and sea cucumbers, as well as the lesser known feather stars, sea lilies and brittle stars.

These are extraordinarily attractive marine invertebrates, and specimens are highly prized by beachcombers, who commonly collect and display the dried skeletons of those that have washed ashore undamaged. Yet these animals are much more than collectable curios...



Astropecten duplicatus
(two spined star)

Asteroids

Sea stars (Class Asteroidea) typically have five hollow unbranched arms (or rays) radiating from a central body or disc, although some species have as many as 50 arms.



Plinthaster dentatus



Astropecten articulatus
(royal sea star)



Goniaster tessellatus



Luidia alternata
(banded sea star)



Narcissia trigonaria



Henricia downeyae



Coronaster briareus

Echinoids

Sea urchins, sand dollars and sea biscuits (Class Echinoidea) have no arms; the body is equipped with movable spines of varying length. "Regular" urchins are typically sub-spherical; "irregular" urchins include the ovoid heart urchins and the discoidal sand dollars.



Clypeaster subdepressus (sand dollar)



Lytechinus variegatus
(variegated urchin)



Mellita isometra (sand dollar)



Cidarid sp.



Echinus tylosides

Sea urchin defensive structures include long sharp spines and the poisonous pincer organs (pedicellariae)

Echinoderms have several distinctive features:

1) A body plan with five-part (pentamerous) radial symmetry

Obvious in the **five-armed** sea stars and brittle stars, and in the **five "petals"** on top of a sand dollar (right). It is not obvious in most sea cucumbers, which are cylindrical and often featureless externally. Internally, however, **five muscle bands** and other structures confirm the **pentamerous body plan** of the sea cucumbers.

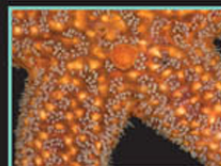


test of *Encope michelini* (notched sand dollar)



2) A calcite (calcium carbonate) skeleton

The individual pieces of **calcite** (known as ossicles) may be quite large, an inch or more across in some species, and may form a hard, rigid skeleton - termed a **test** - as in sand dollars. In contrast, most sea cucumbers have **microscopic ossicles** (below left) embedded in a relatively soft body wall. Linking the ossicles is an array of muscles and/or ligaments that are uniquely specialized to regulate the stiffness of the body wall and to control the movements of its appendages.



3) A water-vascular system

This unique system is composed of branching, **fluid-filled vessels** that give rise to specialized structures such as the remarkable **tube feet** (top right). Tube feet on different parts of the body are variously modified for locomotion, adhesion to the substrate, respiration, burrowing, manipulating food, sensory perception, or performing a combination of tasks. The **madreporite** (below right) regulates **water pressure** within the body of the animal.



Ophiuroids

Brittle stars and basket stars (Class Ophiuroidea) have five solid snake-like or branching arms that are joined to the small central disc.



Ophiophragmus septus



Ophioreis reticulata
(reticulated brittle star)



Ophiotrix angulata
(angular brittle star)



Astracme mucronata
(basket star)



Ophiopsis elegans

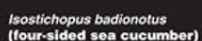
A brittle star seized by its arm tip can drop the arm and escape

Holothurians

Sea cucumbers (Class Holothuroidea) have an elongated cylindrical body that lacks arms and spines. A ring of feeding tentacles surrounds the mouth, and the skeletal elements consist of microscopic ossicles scattered throughout the body wall.



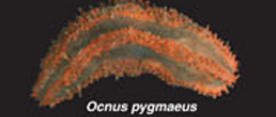
Holothuria princeps



Isostichopus badionotus
(four-sided sea cucumber)



Cucumaria pulcherrima



Ocnus pygmaeus

Sea cucumbers can rapidly and reversibly transform their body walls from a hard to an almost liquid state

Echinoderm Habitats and Behavior

Sea stars, sea urchins and sea cucumbers are often conspicuous on both **sand** and **hard bottom**. Some brittle stars inhabit **crevices** in rocky surfaces, while others cling to animals like **sponges** and **soft corals** or bury themselves in the sand. Burrowing sea urchins, like sand dollars and heart urchins, can form vast **"beds"** in soft offshore sediments, while others live on rocky surfaces. In the deeper waters, sea lilies occur on both hard and soft bottoms.

Sea stars and brittle stars are well known for their ability to **regenerate** their arms if they become detached. Similarly, many sea cucumbers can **eject their internal organs** as a defense mechanism and regenerate them.

Echinoderms are an important part of the marine food web. Their roles vary from that of urchins that **graze on algae**, keeping it from overgrowing reef environments, to sea cucumbers that **ingest sediment** as food, recycling the nutrients. Many sea stars and brittle stars are **active predators** that may even hunt down and eat other echinoderms.



A basket star (*Astrophyton* sp.) clinging to the stems of *Leptogorgia virgulata*



A brittle star associated with the octocoral *Leptogorgia hebes*



Sea stars (*Echinaster* sp.) aggregating on the sea floor



Lytechinus sea urchins frequently attach objects to their aboral side, including shells, seaweed, and even tests of other urchins

Crinoids

The **stalked sea lilies** and **unstalked feather stars** (Class Crinoidea) have a fragile central cup-like body with five or more long feathery arms. This class is considered to be derived from the more primitive line of fossil echinoderm ancestors.



Democrinus sp.
(sea lily)

Pentametrocrinus atlanticus (feather star)

This poster was prepared by:
Southeastern Regional Taxonomic Center
Marine Resources Research Institute, Charleston, SC
With assistance from Dr. David Pawson
(National Museum of Natural History, Smithsonian Institution)
<http://www.dnr.sc.gov/marine/seric>

